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Award Number: W81XWH-08-2-0190

TITLE: Evaluating PTSD on reproductive outcomes: Women deployed in Iraq and Afghanistan

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REPORT DATE: April 2010

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
               Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: (Check one)

     X   Approved for public release; distribution unlimited

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
04-14-2010	Annual	15 SEP 2009 – 14 MAR 2010

4. TITLE AND SUBTITLE
Evaluating PTSD on reproductive outcomes: Women deployed in Iraq and Afghanistan

5a. CONTRACT NUMBER
W81XWH-08-2-0190

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Kathleen O'Rourke

Go ckn<"nqtqwtmgB j gcnj 0wuh0gf w

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of South Florida
Tampa, FL 33612

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research
And Material Command
Fort Detrick, MD 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Women represent nearly 15% of the Armed Forces and almost 11% of those deploying to support Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) in Afghanistan. Military women who become pregnant may be exposed to factors that their civilian counterparts are less likely to experience, including Post Traumatic Stress Disorder (PTSD). The purpose of this study is to determine if PTSD and other mental disorders are significantly associated with maternal and newborn outcomes. The proposed study will utilize a secondary analysis of existing military records. In conjunction with our military partners, we have developed and submitted a protocol requesting de-identified data from military databases, and are awaiting receipt of the files. The study design is a retrospective cohort study: we will first define a cohort of women for whom a Tricare delivery hospitalization record can be found, and then link backward to obtain inpatient, outpatient, and screening records with PTSD (and related disorders) diagnosis codes. We will define women who were "exposed" (had a diagnosis of PTSD prior to pregnancy) and "unexposed" (did not have a diagnosis of PTSD), and compare the incidence of pregnancy outcomes for these 2 groups.

15. SUBJECT TERMS
PTSD, pregnancy, women, obstetric

16. SECURITY CLASSIFICATION OF: U			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON USAMRMC
a. REPORT U	**b. ABSTRACT** U	**c. THIS PAGE** U	UU 1	26 –	**19b. TELEPHONE NUMBER** (include area code)

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

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Introduction

The overall purpose of this study is to examine the association of deployment-related post traumatic stress disorder (PTSD) and related mental disorders with adverse pregnancy outcomes among active-duty military women who have been deployed to Iraq or Afghanistan, and who remained Tricare beneficiaries at the time of their delivery. The study design is a retrospective cohort study: we defined a cohort of women for whom a Tricare delivery hospitalization record was located, and then linked backward to obtain inpatient, outpatient, and screening records with PTSD (and related disorders) diagnosis codes. These earlier records allow us to define women who were "exposed" (had a diagnosis of PTSD prior to pregnancy) and "unexposed" (did not have a diagnosis of PTSD). We will compare the incidence of several specific pregnancy outcomes for these 2 groups of women.

Dr. Angelica Eick, Special Studies Lead at the Armed Forces Health Surveillance Center provided us with 81,229 de-identified military records for active-duty military women who delivered a live born infant or stillborn fetus ($\geq$ 20 weeks gestational age) during calendar years 2004-2008. The study population was identified using the SIDR inpatient data file, which contain records for current Tricare beneficiaries. These records included multiple recortds for some women so they do not reflect the actual size of the populations. Data on these are presented under Key accomplishments.

A. Purpose and Study Aims

The overall purpose of this study is to examine the association of deployment-related post traumatic stress disorder (PTSD) and related mental disorders with adverse pregnancy outcomes among active-duty military women who have been deployed to Iraq or Afghanistan, and who remained Tricare beneficiaries at the time of their delivery. The study design is a retrospective cohort study: we first defined a cohort of women for whom a Tricare delivery hospitalization record can be found, and then linked backward to obtain inpatient, outpatient, and screening records with PTSD (and related disorders) diagnosis codes. These earlier records allow us to define women who were "exposed" (had a diagnosis of PTSD prior to pregnancy) and "unexposed" (did not have a diagnosis of PTSD). We compared the incidence of several specific pregnancy outcomes for these 2 groups of women. This study addresses the following specific aims:

A.1. **Specific Aim 1:** Define a cohort of active-duty military women who meet the following inclusion criteria: (a) delivered a liveborn or stillborn infant during 2004-2008; (b) had Tricare hospitalization delivery records for both the mother and infant.

A.2. **Specific Aim 2:** Using the mother's unique identification number, link backwards in time to obtain deployment records, pre- and post-deployment mental health screening questionnaire results, medical outpatient visit records, and medical inpatient hospitalization records (prior to delivery).

A.3. **Specific Aim 3:** Define maternal exposure status by analyzing prenatal and pre-conceptional medical and screening records for any mention of a PTSD or related mental disorder diagnosis or positive screening test result.

A.4. **Specific Aim 4:** Analyze the cohort data to investigate whether an independent increased risk of adverse pregnancy outcomes existed for the exposed vs. unexposed women, after adjustment for known biomedical and behavioral risk factors for the outcomes.

A.5. **Specific Aim 5:** Disseminate study findings through presentation at national scientific meetings, publication in peer-reviewed medical journals, and special reports and presentations to DOD audiences as requested.

B.   Background and Significance

B.1.   Background

Women represent 14.35% of the Armed Forces in 2007 and 10.6% of those deploying to support Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) in Afghanistan. Women soldiers need have specific social, medical, and physical needs which need to be addressed to maximize their potential. Given the current military environment of frequent and repeated deployments, women are a critical component of operations in the volunteer force. Addressing the needs of women improves their combat readiness, increases recruitment and retention as well as benefits the woman, her family, and the military community as a whole. The mean age of soldiers in the military is 29 years with 65% aged 30 or younger, prime reproductive years. In fact, pregnancy and pregnancy-related conditions are the leading causes for hospitalizations among active duty soldiers and actually account for 21% of the total hospitalizations in the military health system. Thus, the effect of women's military service on reproductive outcomes is a key concern. Due to the unique situation of women in the military, enlisted women who become pregnant may be exposed to factors that their civilian counterparts are less likely to experience. A soldier's exposure to PTSD as a consequence of deployment is one example of recent concern. A recent study found women who had deployed to Iraq/Afghanistan from 2001-2006 had a cumulative post traumatic stress disorder (PTSD) incidence of 2.3% [1]. This condition may have many effects on women's health, including implications for current and future reproductive health.

Thus far, few studies have specifically examined the association between PTSD and its symptomatology on adverse pregnancy outcomes. An OVID search using the key words PTSD and pregnancy outcomes, identified 271 studies, most of which were concerned with stress resulting from pregnancy. From this search, a total of seven analyzing the effect of PTSD on pregnancy outcomes were identified. Six used primary data collection and one was an analysis of pre-existing data. The majority of studies were limited by small sample sizes and difficulties

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in identifying the temporality of PTSD. Studies identified PTSD using varied methodologies and examined a number of different outcomes.

In general, the studies had mixed results and no consistent pattern was demonstrated. A secondary analysis of data conducted by Seng et al. the Michigan's Medicaid Eligibility and Paid Claims records, utilized the ICD-9 diagnostic code of 309.81 from hospital records and billing forms[2]. Five variables were found to be significant using regression analysis: ectopic pregnancy (OR=1.7, 95% CI 1.1-2.8); miscarriage (1.9, 1.3-2.9); hyperemesis (3.9, 2.0-7.4); preterm contractions (1.4, 1.1-1.9); and excessive fetal growth (1.5, 1.0-2.2). Significant findings were not found in relation to preterm birth, gestational diabetes, pre-eclampsia, c-section delivery and other obstetric variables. This study could not assess PTSD temporality and the overall prevalence was relatively low (0.4%), possibly resulting from under-reporting. Rogle et al conducted a study among 1100 pregnant (31 cases and 1079 controls) women enrolled in the Health Start initiative[3]. They did not find any significant relationship between PTSD and obstetric outcomes, although women with PTSD had higher rates of preterm birth than controls, 16.1% vs. 7.0%, respectively. They also identified an association between minor depressive disorder and low birth weight. This study was limited by small numbers of women diagnosed with PTSD. A study of 2,549 women (182 with PTSD and 2,367 controls) in New York City evaluated the impact the World Trade Center attack but did not find any relationship between women with PTSD and intrauterine growth retardation [4]. However, a secondary analysis of these data did identify an association between PTSD and decreased fetal head circumference[5].   Xiong et al evaluated the relationship of PTSD in a sample of women exposed to Hurricaine Katrina and although they found higher rates of low birth weight among women with PTSD, this finding was not significant[6]. A relatively small study (n=101) by Morland et al. evaluated the impact of PTSD on various health behaviors during pregnancy and found women with PTSD were more likely to smoke, abuse alcohol and drugs, and have peer prenatal care but the study did not have sufficient power to identify pregnancy outcomes[7]. A

pilot study with 25 subjects did determine that women who experienced PTSD had lower basal salivary cortisol levels but they did not examine pregnancy outcomes[8].

Although there have been few studies evaluating the impact of PTSD on pregnancy outcomes, research has identified an association between maternal stress and poor pregnancy outcomes, including preterm delivery (birth prior to the 37th week of gestation) and low birth weight (birth of an infant less than 2500 grams). Associations are not limited to stress occurring during pregnancy may be the result of cumulative stressful experiences prior to conception. Collectively low birth weight and preterm delivery account for 50-70% of perinatal mortality and are also strongly associated with perinatal morbidity and high health care costs. Current estimates of low birth weight and preterm delivery in the United States are 8.1% and 12.3%, respectively [9]. Little is known about the association of PTSD with pregnancy outcomes as PTSD is a rarely diagnosed condition among civilian women of childbearing age. While no studies evaluating the relationship of PTSD with pregnancy outcomes were found in the military population, Haas et al. reported that women with partners who were deployed had higher levels of stress and suggested this could impact pregnancy outcomes [10]. In addition, Stinson et al found a trend towards preterm labor with a higher level of perceived negative life events among military women [11]. See table 1 for a review of the selected studies.

The current study should provide important information on the impact of PTSD on pregnancy outcomes. It has advantages over the prior studies as, given the number of deployed women in the military, it should be possible to identify sufficient numbers of participants with and without PTSD. It is also possible to address the issue of temporality as women complete both a pre and post deployment health assessment so responses can be compared between the two time periods. We recognize the limitation in diagnosing PTSD but the inclusion of other mental disorders should add to our understanding of the relationship of stress, depression, and anxiety with PTSD.

B.2   Military Significance

This study has a number of implications for the military. Of primary importance, it has established the feasibility of using the existing military data to identify the impact of PTSD on pregnancy outcomes. This has important implications both for women in the military diagnosed with PTSD as well as implications for future research possibilities. Pregnancy complications can be very costly to woman, both emotionally and financially, as well as result in significant personnel and financial costs to the military. Our early analyses demonstrate an association between PTSD and pregnancy outcomes. If this finding holds up in the adjusted mofdesls, then women could be counseled about this risk, and interventions could potentially be implemented. Additionally this study could provide a template for a method to use existing military data to explore associations of other exposures with pregnancy outcomes among women in the military as well as to evaluate other outcomes potentially associated with PTSD and mental health concerns among the general military personnel.

Table 1. Review of research studies of PTSD and pregnancy outcomes.

Author	Year	Location	Size	Exposure	Outcome	Stat. sig. association?	Findings
<td colspan="8" style="text-align:center">**PTSD**</td>
Berkowitz	2003	USA	182	probable PTSD	IUGR, PTB, LBW	No	No diff w/prob PTSD & RR of PTB (p=.88), LBW (p=.22) or IUGR (p=.94)
Engel*	2005	USA	52	probable PTSD, PTSS	gestational age, head circumference, birth weight	Yes (PTSS + assoc w/age, - assoc w/circ; mod depr + assoc w/age); no (PTSD, BDI, STAI, LEI & PTB, LBW, circ)	1-unit inc in PCL asso w/gest age .04 wks inc, head circ .07 dec; prob PTSD not asso p>.05; mod depr w/age p=.05
Morland	2007	USA	101	PTSD, state-anxiety, depr symp	Mat behav health & poor birth out (lab, del compl, cong anom, LBW, mode deliv, etc)	Yes (poor behavioral health, anx, depr); no (birth outcomes)	All poor hevavioral, anx, depr more w/PTSD (p<.05)
Rogal	2007	USA	1100	PTSD; major, minor depressive & panic disorder	LBW, birth weight, PTB, gestational age	No; yes, minor depr	sub abuse, panic, maj, min occur more w/PTSD (p=.008); PTB risk trend lvl; non-sig w/PTSD, maj, min, panic; min depr on LBW adj OR=1.82 (1.01-3.29) w/p</=0.05
Seng	2005	USA	25	PTSD	Low basal cortisol, worse peri outcomes	Yes	Cortisol diff btn grps (p=.01); PTSD symp sig neg corr (r = - 0725, p<.000) w/OI
Seng	2001	USA	1093	PTSD	spon AB, ect preg, STDs, nausea, vomit & hyper, PT cont, postdate gest, fetal wt	Yes (ect preg, spon AB, Ptcont, macro, hyperem; no (GDM, pre-ec, labor diff)	Drug abuse sig more w/PTSD (p<.001); spont AB, excess vomit sig after Bonferroni correction (p< .002); ect preg, PT cont, exc, poor fetal growth marg sig
Xiong	2008	USA		PTSD & depression	LBW, PTB	No	High freq LBW 3.1 (.79-12.6), 1.3 (.42-3.79);low freq PTB .8 (.10-6.39), .7 (.19-2.56), p>.05; stat sig w/>3 hurr exp

C.   Research Design and Methods

C.1.   Study Population

Our study population consists of active-duty military women (of any age) who delivered a live born infant or stillborn fetus ($\geq$ 20 weeks gestational age) during calendar years 2004-2008. The study population was identified using the SIDR inpatient data file, which contains records for current Tricare beneficiaries. Therefore, active-duty military women who have babies but do not use Tricare were not captured by our study. Secondly, we also do not include women who became pregnant while on active-duty but left the military prior to delivery (and do not use Tricare). However, women who leave the military while pregnant are often eligible for Tricare coverage for their labor and delivery costs, so we may have still captured data for some of these women. We have not yet evaluated this but plan to do so.   Additional inclusion and exclusion criteria are described below under C.2. Measurement of Exposure and C.3. Measurement of Outcomes.

C.2.   Measurement of Exposure (PTSD)

In this study, we are focused on deployment-associated diagnoses and symptoms of PTSD. We recognize that there will be a background prevalence of PTSD in a female military population (consequent to non-combat personal traumatic experiences). We will take a conservative approach to defining exposure in this study. Active-duty military women who were deployed to either Iraq or Afghanistan during 2003-2008, and subsequently tested positive for PTSD in one of the specific ways listed below will be considered "exposed". We have developed three levels of exposure:

1. Highly specific PTSD diagnosis: ICD9 Code „309.81' on any outpatient or inpatient record at the time of the delivery or prior to the birth.

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2. Adjustment disorder based on any of the following ICD9 codes: '3090' '3091' '3092' '30921' '30922' '30923''30924' '30925' '30928' '30929' '3093' '3094''3098' '30981' '30982' '30983' '30989' or '3099'

3. Positive screening for 2 or more questions for PTSD on the Post deployment health assessment or post deployment health reassessment. These questions assess if the participant is avoiding situations, feels detached, has nightmares, or is on guard.

C.3. Measurement of Outcomes (Maternal and Fetal/Infant Complications)

Adverse Outcomes for Mother

Our study is exploratory; consequently we are examining multiple adverse outcomes for the mother for which there is a plausible pathophysiological pathway between PTSD and the outcome. We are examining maternal complications for three distinct time periods: prenatally, peripartum (e.g. during labor and delivery), and postpartum. We have evaluated detailed ICD-9 diagnosis codes and procedure codes from prenatal outpatient clinical records and from the delivery hospitalization record to identify these complications. In the future, we will also examine the method of delivery (vaginal vs. cesarean).

Prenatal Complications	Peripartum Complications	Postpartum Complications
gestational diabetes hypertension preeclampsia infections drug/alcohol use hyperemesis	premature membrane rupture preterm labor hemorrhage failure to progress prolonged labor	hemorrhage stroke infections depression

The initial maternal outcome we are evaluating is hypertension disorder among women during pregnancy or at the time of birth. This analysis is ongoing and we be described in the subsequent report

Adverse Outcomes for Infants

Adverse infant outcomes are recorded on both the mother's and the infant's hospital discharge record. For example, a stillbirth will be recorded on the mother's record. There is also a diagnosis code to indicate whether the baby is low birth weight. More detailed information is available for those cases in which the infant discharge record is successfully linked to the mother's record. We will examine the following infant outcomes: preterm birth, low birth weight, stillbirth, infant death, congenital defects, and other infant complications that can be ascertained through diagnosis and procedure codes. We limited the inital analyses to the first births of all study women. This was done to be able to more clearly define the impact of the exposures and the timing of exposures on the birth outcomes. Further analyses will be expanded to include all births but these require potential adjustment for factors associated with the first birth and exposures prior to that birth as well. We are hoping an analysis of the timing of obstetric complication and exposures during the first birth will help us identify the critical exposure window that can be applied to subsequent births. Initial analysis focused on the following outcomes: still birth, low birth weight, and preterm birth. These are defined as described below:

Still birth

1. Stillbirth „656.40' „656.41' „V27.1' „V27.3' „V27.4' „V27.6' „V27.7'

2. Low birth weight: Any of the following V-codes or ICD 9 Codes: 'V2130' 'V2131' 'V2133''V2134' 'V2135' '76511''76512' '76513' '76514' '76515' '76516' '76517''76518' '76400' '76401' '76402' '76403' '76404''76405' '76406' '76407' '76408' '76409' '76410''76411' '76412' '76413' '76414' '76415' '76416''76417' '76418' '76419' '76420' '76421' '76422''76423' '76424' '76425' '76426' '76427' '76428''76429' '76490' '76491' '76492' '76493' '76494''76495' '76496' '76497' '76498' '76499'

3. Preterm birth: Any of the following V-codes or ICD 9 Codes: '64420' '64421' '76521' '76522' '76523' '76524' '76525' '76526' '76527' '76528' '76510' '76511' '76512' '76514' '76515' '76516' '76517' '76518' '76519' '76500' '76513''76501' '76502' '76503' '76504' '76505' '76506' '76507''76508' '76509'

C.4. Military, Demographic, and Potential Confounding Variables

We are evaluating the effect of a number of demographic and military variables on the described outcomes. We will evaluate the relationship of age, race, education, type of service, and rank with our exposure and outcome variables. In addition, we will be creating a number of deployment variables: deployment yes/no, total length of all deployments, and time from last deployment to the birth of the baby.

C.5. Data Sources, Variables Requested, and Data Linkage Strategy

The table below details the data sources, selection criteria, and variables requested from each data source. As stated above, our study population includes all active-duty military women for whom a hospital delivery record can be located for the period January 1, 2004 – December 31, 2008.

Table 2. Data sources and codes for study variables.

Data Source	Selection Criteria	Variables Requested
SIDR (Mom's Delivery Records)	* Active-duty women * Live birth or stillbirth * Delivery date 01/01/04 - 12/31/08 * Obtain delivery date from linked mom-baby inpatient records * For stillbirths or mom records for which an infant record can not be linked, designate delivery date = mother's admission date + 1 day.	* study ID # * dates of admission and discharge * discharge disposition type * mother's age, race/ethnicity, marital status, military rank * principal and all secondary ICD-9 diagnosis codes * principal and all secondary ICD-9 procedure codes * hospital location (i.e. country and state)
SIDR (Infant Discharge Record)	* Match to Mom's record by sponsor SSN for discharges 2004 - early 2009	* study ID # * dates of admission and discharge * infant date of birth * discharge status and destination * race/ethnicity and gender * principal and secondary ICD-9 diagnosis codes * principal and secondary ICD-9 procedure codes * procedure dates
Post Deployment Health Assessment (PDHA) (older version)	* Match to master list of Mom SSNs * Jan 2002 – Dec 2007	* study ID # Service members' section * Today's date (Date post deployment heath assessment obtained) * Name of unit during this deployment * Service branch * Pay grade * Year of birth * Date(s) of arrival into theater * Date of departure from theater * Name/location of Operation * Occupational specialty during the deployment * Combat specialty * Questions 1-5 on overall health * Question 6 symptom checklist * Questions 7-13 * Questions 24-27 Health care providers' section * Questions 1-6 * Referral for: combat/stress, family, fatigue, mental health, pregnancy, other * Exposure concerns: all
Post Deployment Health Re-Assessment	* Match to master list of Mom SSNs	* study ID # Service members' section

Data Source	Selection Criteria	Variables Requested
(PDHRA) (older version)	* Jan 2002 – Dec 2007	* Today's date (Date post deployment heath assessment obtained) * Marital status * Date(s) of arrival into theater * Date of departure from theater * Service branch * Status prior to deployment * Pay grade * Location of Operation * Since return from deployment I have * Total deployments in past 5 years * Current unit of assignment * Current assignment location * Questions 1-6 on overall health * Question 6a symptom checklist * Questions 7-16 Health care providers' section * Questions 1-4 * Question 5: depression, PTSD, anger, suicide, social, alcohol, other * Question 6: a-c, d (OB/GYN only) e-n * Question 9: declined form, declined interview, declined referral
Post-Deployment Health Assessment PDHA 2008 version	* Match to master list of Mom SSNs * Jan – Dec 2008	* Date * Year of birth, gender * Pay grade * Name of deployment unit, Service Branch, Component * Name of Operation, Date of arrival, Date of departure, Location * Occupational and combat specialties during deployment * Questions 1-20 (inclusive, all parts) * Questions 24-27 Health Care Provider Section * Questions 1-7 * Questions 9-10 * Question 11: combat, depression, PTSD, anger, suicide, social, alcohol, other * Question 12: a-c, OB/GYN, e-l * Question 13 * Question 14: declined form, declined interview, declined referral
Post-Deployment Health Re-Assessment PDHRA 2008 version	* Match to master list of Mom SSNs * Jan – Dec 2008	* Date * Year of birth, gender, marital status * Date arrived, date departed, location of operation * Service branch, pay grade * Status prior to deployment * Since return from deployment * Total deployments * Current unit, current location * Questions 1-18 (inclusive, all parts)

Data Source	Selection Criteria	Variables Requested
		Health Care Provider Section ∗ Questions 1-7 ∗ Question 8: a-c, OB/GYN, e-l ∗ Question 11: declined form, declined interview, declined referral
Active-Duty Administrative and Personnel Data	∗ Match to master list of Mom SSNs ∗ Match dates to infant delivery date ∗ Obtain entry into service update following each deployment	∗ study ID # ∗ Date of entry into service ∗ Branch ∗ Rank ∗ Educational level ∗ Marital status ∗ Dual military family ∗ Approximate date of discharge when available ∗ Type of discharge ∗ MOS (military occupational specialty-enlisted) ∗ AOC (Area of Concentration-Officers)
SIDR (Mom Prepregnancy and Antenatal Hospitalizations)	∗ Match to master list of Mom SSNs AND earliest deployment dates ∗ For the period 2001 – 2008, capture any records with ICD-9 diagnosis codes 290-319, 630-677, V11, V79 ∗ For the 12 months prior to date of infant delivery, capture all records hospitalizations	∗ study ID # ∗ dates of admission and discharge ∗ discharge status and destination ∗ marital status ∗ principal and secondary ICD-9 diagnosis codes ∗ principal and secondary ICD-9 procedure codes ∗ procedure dates ∗ hospital type and location (i.e. country and state)
SADR (Mom Prepregnancy and Antenatal Outpatient Records)	∗ Match to master list of Mom SSNs AND earliest deployment dates ∗ For the period 2001 – 2008, capture any records with ICD-9 diagnosis codes 290-319, 630-677, V11, V79 ∗ For the 12 months prior to date of infant delivery, capture all records	∗ study ID # ∗ date of visit ∗ marital status ∗ principal and secondary ICD-9 diagnosis codes ∗ principal and secondary ICD-9 procedure codes ∗ procedure dates ∗ clinic type and location (i.e. country and state)
Pre-Deployment Health Assessment	∗ Match to master list of Mom SSNs	Service members' section ∗ Today's date (Date post deployment heath assessment obtained) ∗ Deploying Unit ∗ Service branch ∗ Pay grade ∗ Date of birth ∗ Questions 1-8 health assessment Health care providers' section ∗ Referral indicated ∗ Final Medical Disposition ∗ Deployable/Not deployable

C.5.   Protection of Privacy

All data files provided to us were de-identified with names and social security numbers removed. Mother's date of birth was masked; we have her age and the year of delivery. There is an adjusted date so the timing of events can be calculated relative to the first birth. Some of the records has errors in the calculation of the birth date so a global date adjustment was created to allow us to set the initial date as 0 for the date of the first birth.

D. Key Research Accomplishments

We have made the following progress on our specific aims, described in greater detail in this section:

A. Specific Aims A. 1 and A. 2 are complete. On September21, 2009, we received the final data set.

B. We have made progress on Aim A.3. We have identified exposure for PTSD, adjustment disorder, and a positive screening for PTSD.   We are still in the process of identifying depression and other important mental disorders.

C. We have made progress on A.4 for the outcomes of pregnancy –induced hypertension, still birth, low birth weight, and preterm birth.

D. We have made progress on Aim A.5, having presented the study at to conferences and have and have two additional abstracts submitted to future conferences, as described below. We have also initiated work on two manuscripts.

We have reviewed the literature to identify meaningful associations between PTSD and other mental health disorders with maternal and newborn pregnancy outcomes. While there are few studies of PTSD and pregnancy outcomes, we have based our review on studies evaluating the impact of stress on pregnancy outcomes. We have prioritized the following outcomes,

based upon this review and the availability of records: stillbirth, preterm birth, low birth weight, and pregnancy-induced hypertension, pre-eclampsia, and eclampsia. Tables 3 and 4 provide demographic and military data for women with singleton deliveries (live born or stillborn) during or study period.

Table 3. Characteristics of Active-Duty Military Mothers* at the Time of Delivery.
N=63,779

Characteristic	Percent	Number
Age		
18-24 years	53.3	33,973
25-29 years	28.0	17,857
30-34 years	12.7	8,071
35+ years	6.1	3,878
Race/Ethnicity		
White	47.6	30,382
Black	28.5	18,152
Hispanic	13.1	8,352
Asian	5.3	3,395
Other/Unknown	5.5	3,498
Marital Status		
Married	69.7	44,459
Single/Never Married	26.3	16,757
Other/Unknown	4.0	2,563
Deployment Status, 2001-2008		
Never deployed	54.9	35,002
First deployment before pregnancy	33.3	21,237
First deployment after pregnancy	11.8	7,540
Grade		
Enlisted	88.0	56,127
Officer/Warrant Officer	12.0	7,652
Year of Delivery		
2004	23.6	15,071
2005	22.2	14,145
2006	18.8	11,996
2007	18.6	11,833
2008	16.8	10,734

* Includes women with singleton deliveries (live birth or still birth) between 2004-2008.
   Data on the earliest birth during the study period for each mother are included
   here.

Table 4. Characteristics of Active-Duty Military Mothers* at the Time of First Deployment Prior to Pregnancy, n=21,237

Characteristic	Percent	Number
Age		
18-24 years	46.3	9,827
25-29 years	33.6	7,141
30-34 years	14.1	2,990
35+ years	6.0	1,279
Race/Ethnicity		
White	43.8	9,302
Black	31.7	6,731
Hispanic	14.0	2,971
Asian	5.5	1,159
Other/Unknown	5.1	1,074
Marital Status		
Married	39.8	8,454
Single/Never Married	55.7	11,822
Other/Unknown	4.5	961
Educational Attainment		
Did not finish high school	0.5	101
High school diploma	82.6	17,545
Some college	4.5	964
College degree	8.6	1,825
Graduate degree	2.1	434
Unknown	1.7	368
Grade		
Enlisted	89.7	19,057
Officer/Warrant Officer	10.3	2,180
Service		
Army	38.0	8,062
Navy	30.2	6,421
Air Force	26.6	5,647
Marines	5.1	1,089
Coast Guard	0.1	18
Operation		
Iraqi Freedom	68.8	14,611
Enduring Freedom	29.7	6,316
Kosovo	0.9	192
Southwest Asia	0.6	118

* Includes women with singleton deliveries (live birth or still birth) between 2004-2008. Data on the earliest birth during the study period for each mother are included here.

We identified three mental health outcomes among our study participants: (1) PTSD determined by clinical evaluation, (2) Adjustment Disorder determined by clinical evaluation, and (3) a positive a screening on either the post deployment health assessment or the post deployment health reassessment. Table 5 provides the rates for these conditions.

Table 5. Rates of adverse mental health outcomes among women having their first birth in the military from 2004 and 2008 (n=56,895.).

Outcome	Number	Percent
PTSD diagnosis	436	0.77
Adjustment disorder diagnosis	5583	9.81
Positive PTSD screening	1801	3.17

The crude analyses of the association of mental health outcomes with obstetric outcomes (Tables 6-8) show that there is a significant association of elevated rates of preterm birth among women with a clinical diagnosis of PTSD as well as a association of borderline significance with adjustment disorder and preterm birth., but no association for a positive PTSD screening. There is also a borderline association between adjustment disorder and stillbirth.

Table 6. Crude analysis of the association of clinically diagnosed PTSD with infant birth outcomes among women having their earliest birth in the military from 2004 and 2008 (n=56,895.).

Variable	Has PTSD n (%)	Does not have PTSD n (%)	p-value
Preterm birth	44 (10.09)	3955 (7.01)	0.012
Stillbirth	2 (0.46)	192 (0.34)	0.672
Low birth weight	20 (4.59)	2420 (4.29)	0.757

Table 7. Crude analysis of the association of clinically diagnosed adjustment disorder with infant birth outcomes among women having their earliest birth in the military from 2004 and 2008 (n=56,895.).

Variable	Has adjustment disorder n (%)	Does not have adjustment disorder n (%)	p-value
Preterm birth	3572 (6.96)	427 (7.65)	0.057
Stillbirth	26 (0.47)	168 (0.33)	0.092
Low birth weight	247 (4.42)	2193 (4.27)	0.599

Table 8. Crude analysis of the association of positive PTSD screening with infant birth outcomes among women having their earliest birth in the military from 2004 and 2008 (n=56,895.).

Variable	Has positive PTSD screening n (%)	Does not have positive PTSD screening n (%)	p-value
Preterm birth	3866 (7.02)	133 (7.38)	0.548
Stillbirth	186 (0.34)	8 (0.44)	0.445
Low birth weight	76 (4.22)	2364 (4.29)	0.884

E. Reportable Outcomes

There were two presentations on the research projects.

1. O'Rourke K, Pathak E, Roddy M, and Custer M. The Association of Post Traumatic Stress

Disorder with Pregnancy Outcomes among Women in the Military, Poster and Oral presentation

at the Military Health Research Forum 2009, Kansas City, MO 8/31/09-9/3/09.

2. O'Rourke K and Coulter M. The impact of PTSD on pregnancy outcomes among women in

the military. Oral presentation at the 12 Annual Force Health Protection Conference,

Albuquerque, NM, August 2009.

The flowing abstracts have been submitted:

O'Rourke K, Pathak E, Roddy M, and Custer M Association of Post Traumatic Stress Disorder

among U.S. Military Women with Preterm Birth and Low Birth Weight for the 2010 American

Public Health Association conference in Denver, CO.

O'Rourke K, Pathak E, Roddy M, and Custer M. Association of Post Traumatic Stress Disorder among U.S. Military Women with Preterm Birth and Low Birth Weight for the 13th Annual Force Health Protection Conference in Phoenix 2010.

Two manuscripts are in progress, one evaluating the association of PTSD with stillbirth, preterm birth, and low birth weight, and the othere evaluating the association of PTSD with hypertension in pregnancy.

F. Conclusion

Although much of the analysis is still ongoing, significant progress has been achieved. We have merged a number of datasets and managed the time sequencing of events. We have developed a dataset to evaluate birth outcomes for the earliest birth for military women during the study period. We have identified a number of key exposures: PTSD, adjustment disorder, and positive PTSD screening. We have also identified several key outcomes: stillbirth, low birth weight, pretem birth, gestational hypertension and pre-eclampsia.. Our crude analysis shows a significant association between PTSD diagnosis and preterm birth, as well as a borderline association between adjustment disorder with preterm birth and stillbirth. We are in the process of conducting adjusted analysis of this association and other associations. We look forward to completing these initial manuscripts in the near future and exploring mechanism by which we can continue the analysis of this dataset.

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